NSLS TECHNICAL NOTE	NUMBER
BROOKHAVEN NATIONAL LABORATORY	**526**

AUTHOR	DATE
Jeffrey Rothman	October 19, 2004

TITLE	
BPM Calibration and Stability	

This tech note outlines the characteristics of the RF receivers used to monitor beam position in the NSLS storage rings. It describes the method used to calibrate the receivers. The calibration accuracy, drift over time, and limiting factors are also specified.

It was originally presented at the October 6th, 2004 NSLS Studies Meeting.

BPM CALIBRATION PROCEDURE

Presented by J. Rothman
10/06/04

- How are the receivers calibrated?
- What is the calibration accuracy?
- What is the drift over time?
- What limits the accuracy?
- How are we dealing with receivers that fail?

Receiver Calibration

- Inject equal amplitude signals into the receiver. Adjust the zero

- Simulate 3.8mm offset in the vertical and 3.2mm offset in the horizontal by inserting 3dB attenuators. Adjust the scale factors
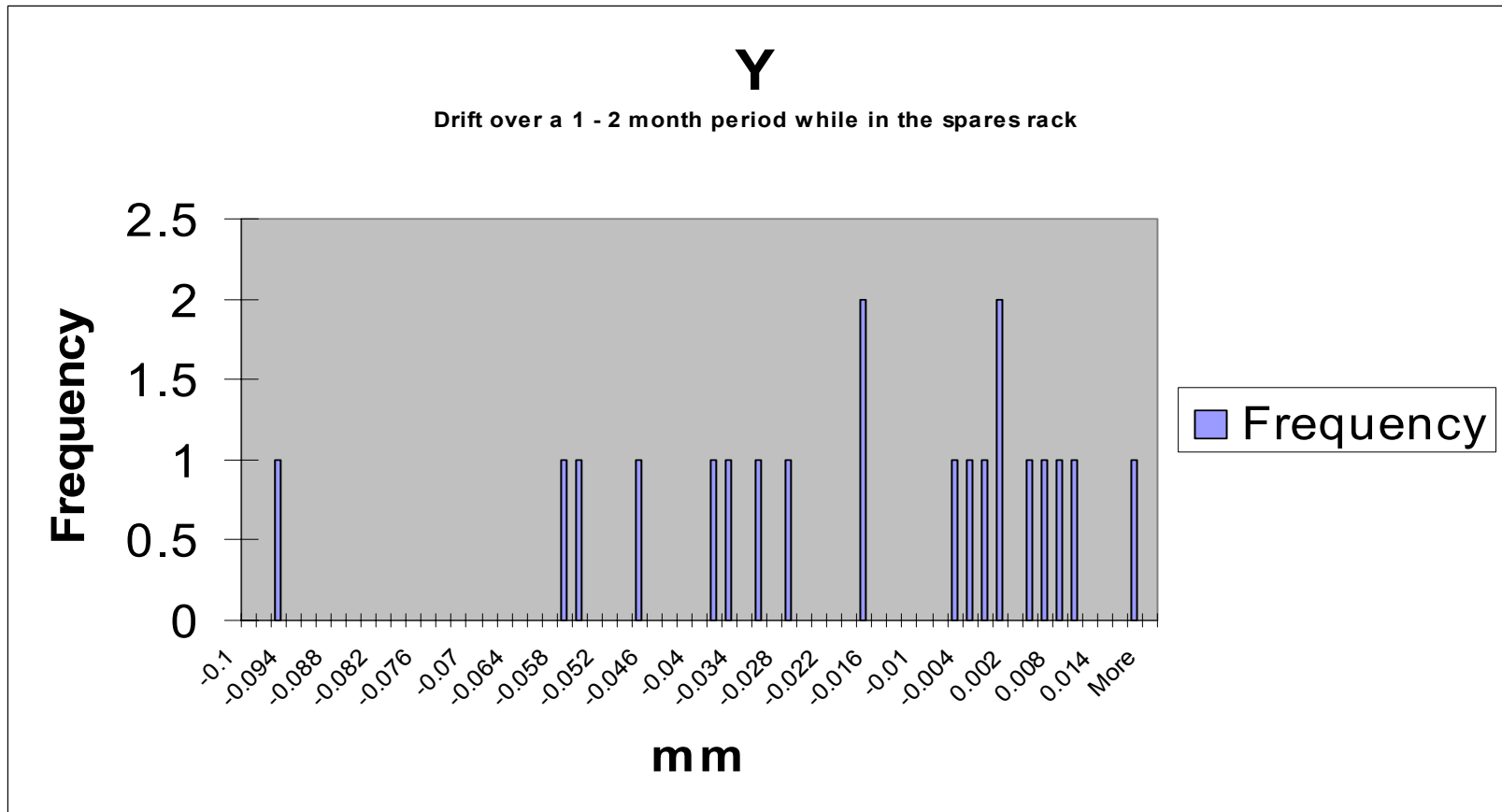
Calibration Accuracy

- 0mm ± 15µm repeatability
- -3.8mm ± 20µm repeatability
- ± 10µm over 40dB change in beam current
- Systematic scale factor error 2%

  due to attenuation (3.062dB) All receivers affected in the same way
- Attenuator temperature coefficient 200ppm
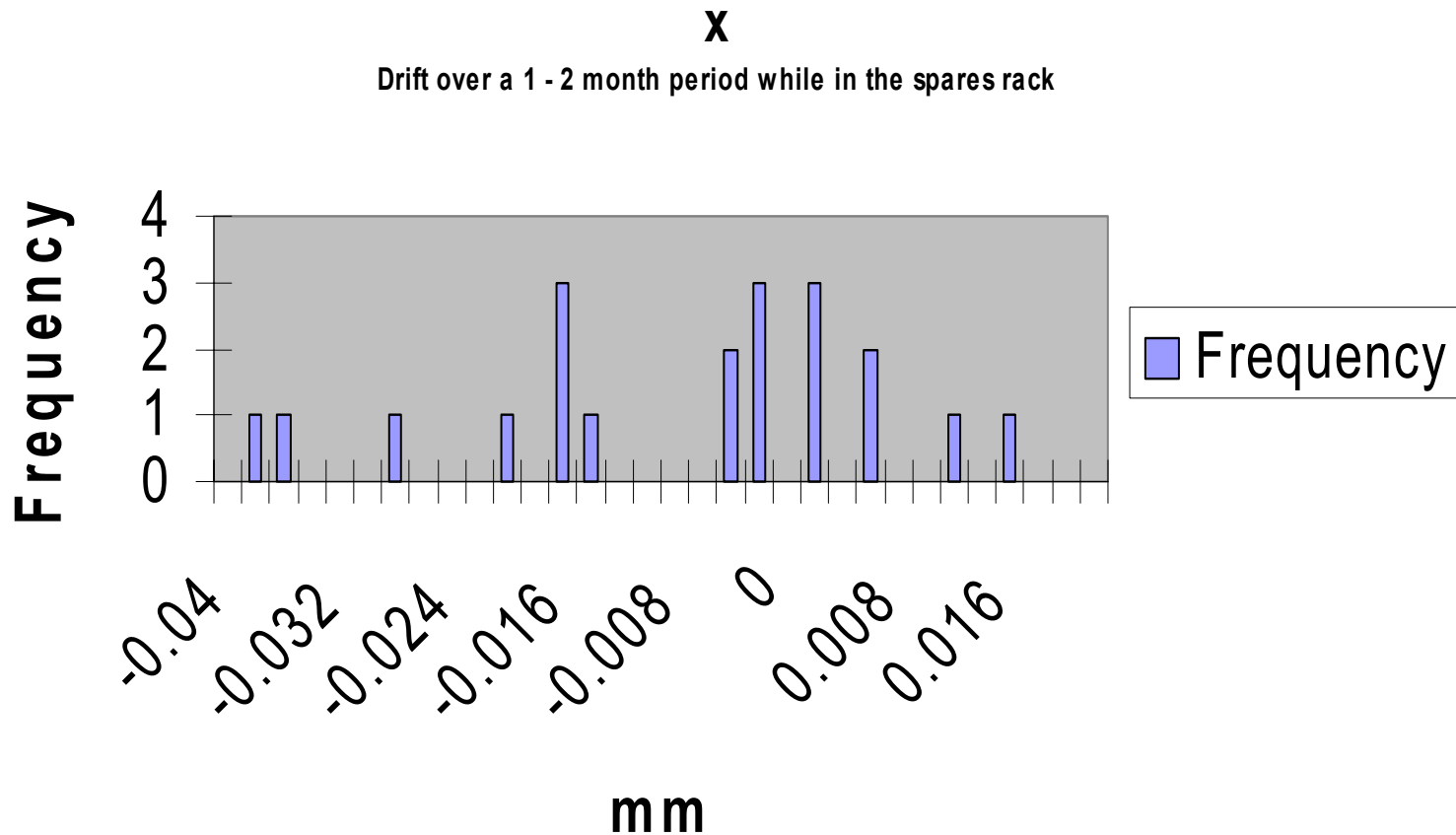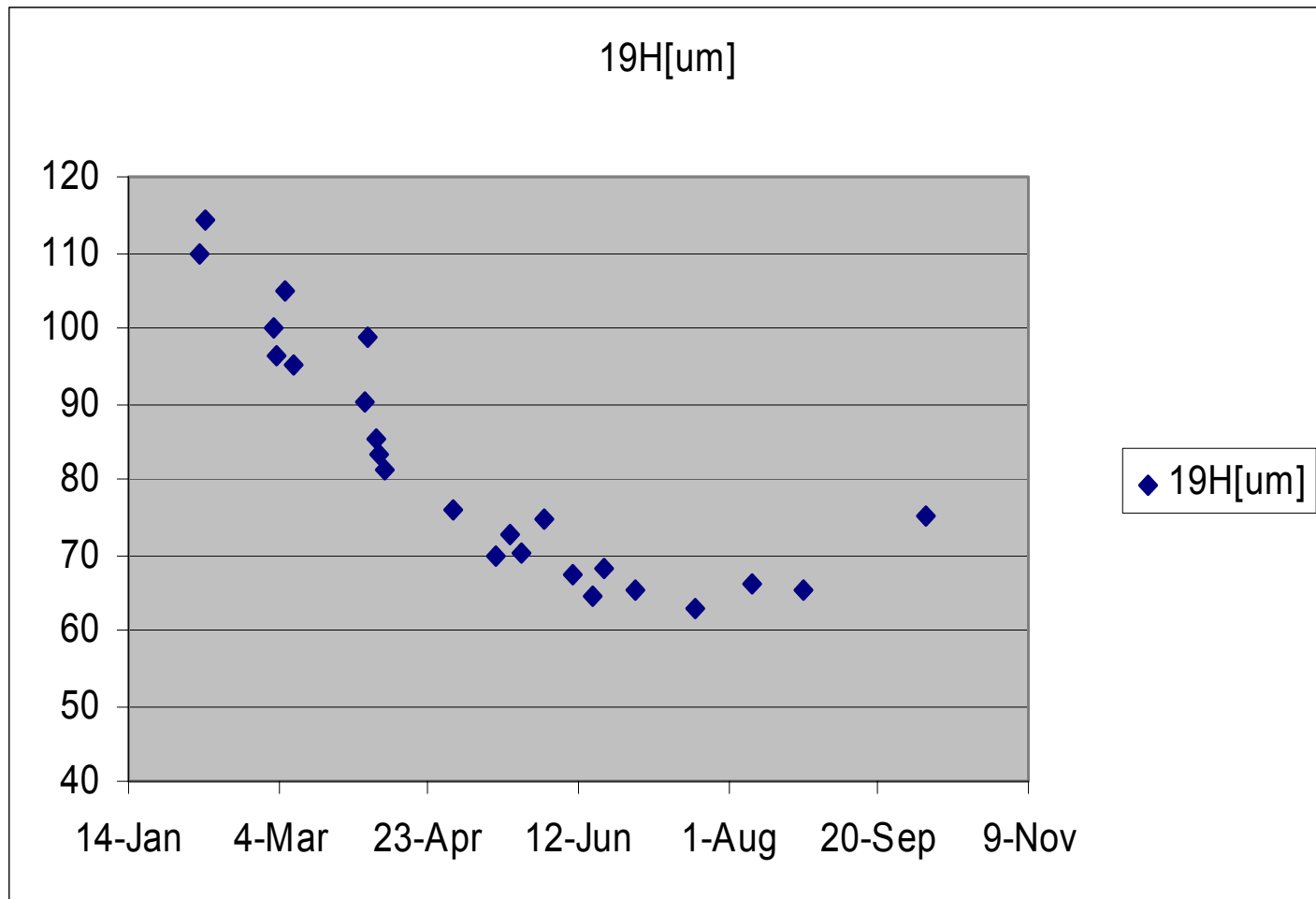
Combined drift of receiver and test splitter

Combined drift of receiver and test splitter

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Drift over a 1 - 2 month period while in the spares rack
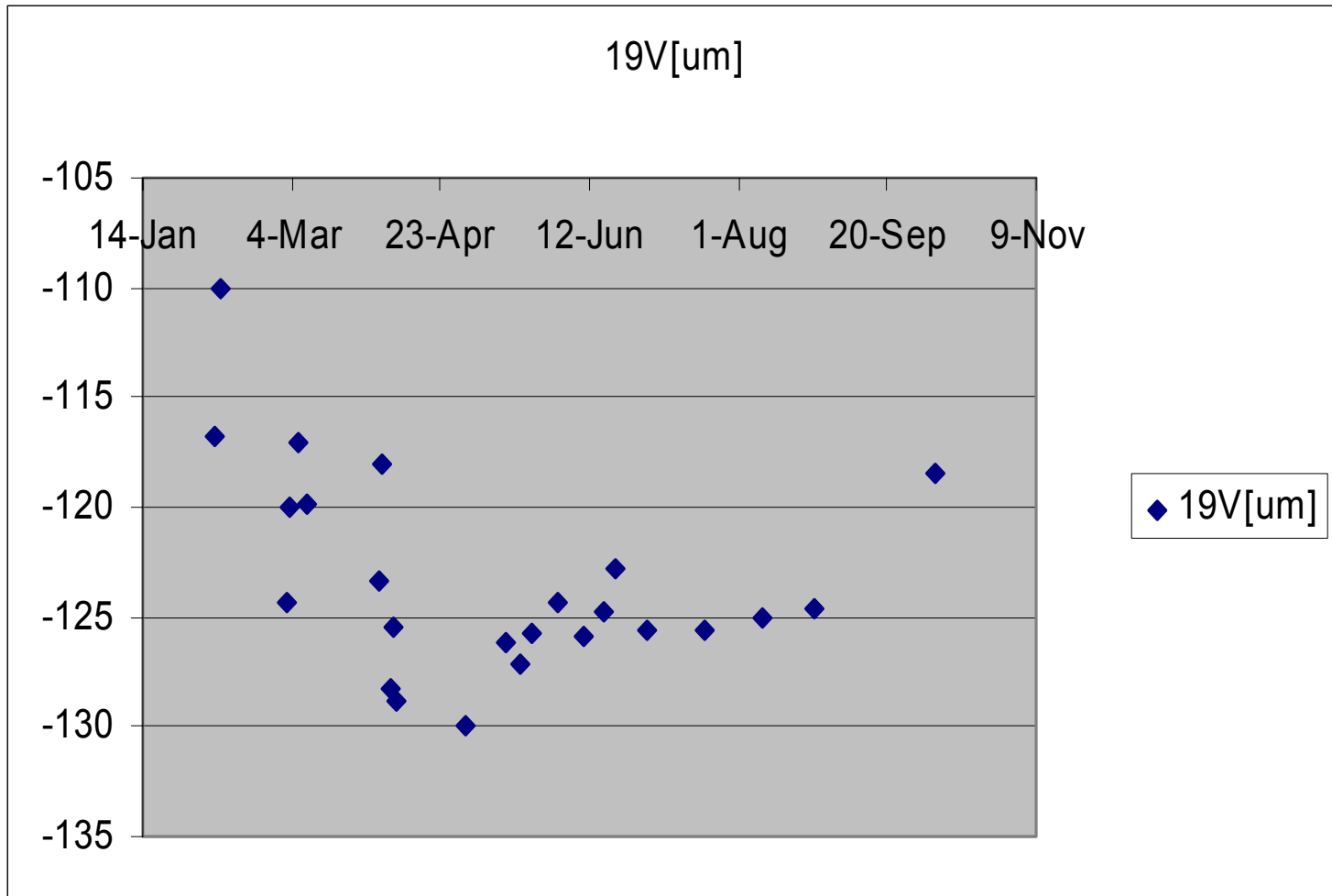
Combined drift of receiver and test splitter

Receiver driven by a single button from the ring split 4 ways

Combined drift of receiver and test splitter

Receiver driven by a single button from the ring split 4 ways

Overall Measurement Drift with Time

- Vertical orbit can be corrected to the reference orbit with an RMS error of 30μm. This is consistent with the other long term drift measurements.

- Horizontal RMS error is larger due to pipe motion (75μm).

Accuracy Limits

- Electrical center of buttons is unknown
- Damaged SMA connectors on the buttons
- Chamber motion ~200µm in horizontal w/ coupling to the vertical in some locations ~20 µm
- Radiation damage to semiconductors
- Receiver + test splitter temperature coefficient causes ~50 µm variation Summer/Winter

Damaged Receiver Replacement

- Disable receiver from feedback

- Replace receiver

- Remove offset from the reference orbit

- Enable receiver in feedback